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10/519,449

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EXAMINER

ALAM, RASHID A

ART UNIT

PAPER NUMBER

1795

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|--------------------------------------|---|--|
| Office Action Summary | Application No. 10/519,449 | Applicant(s) SUGAWARA, MINORU | |
| | Examiner RASHID ALAM | Art Unit 1795 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 August 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Detailed Action

Claim Rejections - 35 USC § 112

Claim 18 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In the instant case, claim 18 depends on itself. For the purpose of prosecution, it is assumed claim 18 depends from claim 16.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1, 2, 5, 9, 10, 16, and 17, are rejected under 35 U.S.C. 102(b) as being anticipated by Tennant (US 5,521,031).

Regarding claim 1, 9, and 16, Tennant teaches a phase mask that deals with reflected light (see abstract) with a first and second region (see figure 1) in which the mask is a reflecting mask including a reflecting substrate with its reflectivity dependent on a multi-layer distributed reflector, and in that blocking regions mask the reflecting substrate from incident radiation, the thickness of the blocking regions being such as to impose a phase shift of about 90 degrees for one-way passage of radiation, in which the thickness and refractive index of the blocking regions is such as to provide this phase shift for radiation of a wavelength within the wavelength range (see claim 1).

Regarding claim 2, 10, and 17, EUV, X-ray, ultraviolet rays, radioactive waves, and visible light are employed (see column 1, lines 10-27).

Regarding claim 5, Tennant teaches a multilayer reflector (see abstract).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 3, 6-8, 11-15, and 18-20, are rejected under 35 U.S.C. 103(a) as being unpatentable over Tennant (US 5,521,031), as applied to claims 1, 2, 5, 9, 10, 16, and 17 in view of Iwamatsu (US 5,609,977).

Regarding claim 3, Tennant teaches as stated above. However, Tennant is silent about the reflected light being equal.

Iwamatsu teaches light reflected is equal in intensity (see column 14, lines 45-64 and abstract). Therefore, it would have been obvious to one skilled in the art at the time of the invention to have equal intensities of reflected light in the fabrication of a phase shift mask by Tennant, because Iwamatsu teaches light reflected is equal in intensity in a reflection phase shifting mask in order to provide a reflection phase shifting mask which can solve the problem of deterioration in quality due to radiation, posed in a transmission mask, and which can have a phase difference of 180 degrees.

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Regarding claim 6, 13, and 18, Tennant teaches lines and spaces (see column 6, lines 47-51) which reflect light and phase masks with varying transmission (see column 6, lines 51-55). However, Tennant is silent about iso-contour lines.

Iwamatsu teaches a reflection mask with lines that are able to invert the phase of the light and reflect the light (see column 2, lines 29-31 and column 9, lines 4-10). Therefore, it would have been obvious to one skilled in the art at the time of the invention to have a reflection type phase shift mask with iso-contour lines by Tennant, because Iwamatsu teaches lines that are able to invert the phase of the light and reflect the light in order to provide a reflection phase shifting mask designed to prevent exposure light from being influenced by a phase amount error with respect to an etching amount in the direction of depth by using only surface reflected light in controlling a phase difference.

Regarding claim 7, 14, and 19, Tennant teaches as stated above. However, Tennant is silent about imaginary numbers being used in the calculations.

Iwamatsu teaches a complex index N of refraction of a material, which includes the iso-phase contour lines, can be expressed by an equation in which n is the refractive index of the material, k is the extinction coefficient, and i is an imaginary unit (see column 21, lines 45-51). Therefore, it would have been obvious to one skilled in the art at the time of the invention to calculate the iso-phase contour lines with the use of imaginary numbers by Tennant, because Iwamatsu teaches a complex index N of refraction of a material, which includes the iso-phase contour lines, can be expressed by an equation in which n is the refractive index of the material, k is the extinction

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coefficient, and i is an imaginary unit to obtain an amplitude reflectance of the multilayered film.

Regarding claims 8, 15, and 20, Tennant teaches as stated above. However, Tennant is silent about the mask being a half tone type mask and a Levenson type mask.

Iwamatsu teaches the resultant mask can be used as a halftone or Levenson type mask depending on the relationship between reflectance (see column 19, lines 25-27). Therefore, it would have been obvious to one skilled in the art at the time of the invention to have a phase shift mask that is a halftone or Levenson type mask by Tennant, because Iwamatsu teaches the resultant mask can be used as a halftone or Levenson type mask depending on the relationship between reflectance in order to obtain the surface reflection of the mask.

Regarding claim 11, Tennant teaches as stated above. However, Tennant is silent about considering interference of film.

Iwamatsu teaches considering the interference effect (see column 11, lines 23-27). Therefore, it would have been obvious to one skilled in the art at the time of the invention to consider interference of film in a phase shift mask by Tennant, because Iwamatsu teaches considering the interference effect in order to remedy the issue of multiple reflection of a multilayer mask.

Regarding claim 12, Tennant teaches as stated above. However, Tennant is silent about the total film thickness and the refractive index being used to determine phase difference.

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Iwamatsu teaches a thickness d and refractive index n_1 are used to determine the phase difference (see column 3, lines 10-22). Therefore, it would have been obvious to one skilled in the art at the time of the invention to use the total film thickness and the refractive index in calculating a phase difference of a phase shift mask, because Iwamatsu teaches a thickness d and refractive index n_1 are used to determine the phase difference in order to get a phase difference of 180 degrees between light reflected by the substrate and light reflected by the phase shifter (phase shifting layer) in consideration of multiple reflection.

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tennant (US 5,521,031), as applied to claims 1, 2, 5, 9, 10, 16, and 17, in view of Scott (US 5,935,733).

Regarding claim 4, Tennant teaches as stated above. However, Tennant is silent about the thickness of the two regions being equal.

Scott teaches two regions on a mask; a phase shifter element region and a transmissive material 52, which are equal in thickness (see column 11, lines 55-66). Therefore, it would have been obvious to one skilled in the art at the time of the invention to have two regions on a phase shift mask being equal in thickness by Tennant, because Scott teaches two regions on a mask, a phase shifter element region

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and a transmissive material 52, which are equal in thickness where the fabrication technique can accommodate multiple phase shifting materials.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RASHID ALAM whose telephone number is (571)270-3959. The examiner can normally be reached on Mon.-Fri. 7:30 am-5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mark F. Huff/
Supervisory Patent Examiner, Art Unit
1795

/RASHID ALAM/
Examiner, Art Unit 1795